early days of geology, when the destructive influence of chemical processes in strata upon the remains of organisms in them was hardly admitted.

The great value of such researches as those so ably carried out by Thomson, Carpenter, and Jeffreys, is the definite knowledge they impart to the geologist who is theorising in the right direction, but whose notions of the depths at which the sediments containing Invertebrata can be deposited, are indefinite. The researches contribute to more exact knowledge, and they will materially assist the development of those hypotheses which are current amongst advanced geologists into fixed theories. I do not think that any geological theory worthy of the term, and which has originated from geological induction, will be upset by these careful investigations into the bathymetrical distribution of life and temperature. Physicists have propounded theories which have been accepted by some geologists; but they are looked upon as doubtful hypotheses by others. Palæontologists and such theories have constantly been at issue. The theories involving pressure and the intensity of the hardness of deep-sea deposits will suffer from the researches; but many difficulties in the way of the palæontologist will be removed. The researches explain the occurrence of a magnificent deep-coral fauna in the Palæozoic times in high latitudes, and of Jurassic and Cainozoic faunas on the same area, and they tend more than ever to the doctrines of uniformity. They explain the cosmopolitan nature of many organisms, past and present, which were credited with a deep-sea habitat, and they afford the foundations for a theory upon the world-wide distribution of many forms during every geological formation. It is not advisable, however, to make too much of the interesting identities and resemblances of some of the deep-sea and abyssal forms with those of such periods as the Cretaceous, for instance. In the early days of geological science there was a favourite theory that at the expiration of a period the whole of the life of the globe was destroyed, and that at the commencement of the succeeding, a new creation took place. There were as many destructions and creations as periods, or, to use the words of an American geologist, there was a succession of platforms. This theory held back the science, just as the theory that the sun revolved round the earth retarded the progress of astronomy. Moreover, it had that armour of sanctity to protect it which is so hard to pierce by the most reasonable opposition. Nevertheless every now and then a geologist recognised the same fossils in rocks which belonged to different periods. A magnificent essay by Edward Forbes on the Cretaceous Fossils of Southern India, a wonderful production and far before its age,* gave hope and confidence to the few palæontologists who began to assert that periods were perfectly artificial notions; that it did not follow because one set of deposits was forming in one part of the world, others exactly corresponding to it elsewhere, so far as the organic remains are concerned, were contemporaneous; and that life had progressed on the globe continuously and without a break from the dawn of it to the present time. The persistence of some species through great vertical ranges of strata, and the relation between the world-wide distribution of forms and this persistence, were noticed by d'Archiac, de Verneuil, Forbes, and others. The identity of some species in the remote natural-history provinces of the existing state of things, was established in spite of the dogmatic opposition of authorities; and these geologists accepted the theories that there were several natural-history provinces during every artificial period; that some species lived longer and wandered more than others; and that some have lasted even from the Palæozoic age to the present. Persistence of type was the title of a lecture delivered by Professor Huxley† many years ago; and this persistence has been admitted by every palæontologist who has had the opportunity of examining large series of fossils from every formation from all parts of the world.

Geological ages are characterised by a number of organisms which are not found in others, and by the grouping of numerous species which are allied to those of preceding and succeeding times, but which are not identical. Certain portions of the world's surface were tenanted by particular groups of forms during every geological age, and there was a similarity of arrangement in this grouping under the same external physical conditions. To use Huxley's term, the "homotaxis" of certain natural history provinces during the successive geological ages has been very exact. The species differed, but there was a philosophy in the consecutive arrangements of high-land and low-land faunas and floras, and of those of shallow seas, deep seas, oceans, and reef-areas. The oceanic * conditions, for instance, can be traced by organic remains from the Laurentian to the present time, and the deep-sea corals now under consideration are representative of those of older deep seas. The species which are new, and the varieties of those which have been already noticed, will be described and drawn in other communications. It is not a matter for surprise, then, that there being such a thing as persistence of type and of species, some very old forms should have lived on through the ages whilst their surroundings were changed over and over again. But this persistence does not indicate that there have not been sufficient physical and biological changes during its lasting to alter the face of all things enough to give geologists the right of asserting the constant succession of periods. The occurrence of early Cainozoic Madreporaria in the deep sea to the north-west of Great Britain only proves that certain forms of life have persisted during the vast changes in the physical geography of the world which were initiated by the upheaval of the Alps, the Himalayas, and large masses of the Andes. To say that we are therefore still in the Cainozoic age would hardly be consistent with the necessary terminology of geological science.

During the end of the Miocene age, and the whole of the Pliocene, the Sicilian area was occupied by a deep sea. The distinction between the faunas of those times and the present becomes less, year after year, as science progresses; and it is evident that a great number of existing species of nearly every class flourished before the occurrence of the great changes in physical geology which have become the artificial breaks of classificatory geologists. That the Cainozoic deep-sea corals should resemble, and in some instances should be identical in species with, the forms now inhabiting vast depths, is therefore quite according to the philosophy of modern geology. Before the deposition of the Cainozoic strata, and whilst the deep-sea deposits of the Eocene age were collecting in the Franco-British area, there was a Madreporarian fauna there which was singularly like unto that which followed it, both as regards the shape of the forms and their genera. Still earlier, during the slow subsidence of the great Upper Cretaceous deep-sea area, there was a coral fauna in the north and west of Europe, of which the existing is very representative. The simple forms predominate in both faunas. *Caryophyllia* is a dominant genus in either, and a branching *Synhelia* of the old fauna is replaced in the present state of things by a branching *Lophohelia*. The similarity of deep-sea coral faunas might be carried still further back in the world's history; but it must be enough for my purpose to assert the representative character and the homotaxis of the Upper Cretaceous, the Tertiary, and the existing deep-sea coral faunas. This character is enhanced by the persistence of types; but still the representative faunas are separable by vast intervals of time.

P. M. DUNCAN

* Trans. Geol. Soc.

† Royal Institution. See also Pres. Address, Geol. Soc.

* P. M. Duncan, Quart. Journ. Geol. Soc. No. 101.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, March 31.—"On the relation between sun's altitude and the chemical intensity of total daylight in a cloudless sky." By Henry E. Roscoe, F.R.S., and T. E. Thorpe, Ph.D. In this communication the authors give the results of a series of determinations of the chemical intensity of total daylight made in the autumn of 1867 on the flat tableland on the southern side of the Tagus, about $8\frac{1}{2}$ miles to the south-east of Lisbon, under a cloudless sky, with the object of ascertaining the relation existing between the solar altitude and the chemical intensity. The method of measurement adopted was that described in a previous communication to the Society,† founded upon the exact estimation of the tint which standard sensitive paper assumes when exposed for a given time to the action of daylight. The experiments were made as follows :—1. The chemical action of total daylight was observed in the ordinary manner. 2. The chemical action of the diffused daylight was then observed by throwing on to the exposed paper the shadow of a small blackened brass ball, placed at such a distance that its apparent diameter, seen from the position of the paper, was slightly larger than that of the sun's disk. 3. Observation No. 1 was repeated. 4. Observation No. 2 was repeated.

† Roscoe, Bakerian Lecture, 1865.

The means of observations 1 and 3 and of 2 and 4 were then taken. The sun's altitude was determined by a sextant and artificial horizon, immediately before and immediately after the observations of chemical intensity, the altitude at the time of observation being ascertained by interpolation.

It was first shown that an accidental variation in the position of the brass ball within limits of distance from the paper, varying from 140 millimetres to 230 millimetres, was without any appreciable effect on the results. One of the 134 sets of observations was made as nearly as possible every hour, and they thus naturally fall into seven groups, viz. :—

(1) Six hours from noon, (2) five hours from noon, (3) four hours from noon, (4) three hours from noon, (5) two hours from noon, (6) one hour from noon, (7) noon.

Each of the first six of these groups contain two separate sets of observations, (1) those made before noon, (2) those made after noon. It has already been pointed out,* from experiments made at Kew, that the mean chemical intensity of total daylight for hours equidistant from noon is constant. The results of the present series of experiments proves that this conclusion holds good generally, and a Table is given showing the close approximation of the numbers obtained at hours equidistant from noon.

Curves are given showing the daily march of chemical intensity at Lisbon in August, compared with that at Kew for the preceding August, and at Parà for the preceding April. The value of the mean chemical intensity at Kew is represented by the number 94·5, that at Lisbon by 110, and that at Parà by 313·3, light of the intensity 1·0 acting for 24 hours being taken as 1,000.

The following Table gives the results of the observations arranged according to the sun's altitude :—

No. of Observations.	Mean Altitude. ° ′	Chemical Intensity. Sun.	Sky.	Total.
15 . .	9 51	0·000	0·038	0·038
18 . .	19 41	0·023	0·063	0·085
22 . .	31 14	0·052	0·100	0·152
22 . .	42 13	0·100	0·115	0·215
19 . .	53 09	0·136	0·126	0·262
24 . .	61 08	0·195	0·132	0·327
11 . .	64 14	0·221	0·138	0·359

Curves are given showing the relation between the direct sunlight (column 3) and diffuse daylight (column 4) in terms of the altitude. The curve of direct sunlight cuts the base line at 10°, showing that the conclusion formerly arrived at by one of the authors is correct, and that at altitudes below 10° the direct sunlight is robbed of almost all its chemically active rays. The relation between the total chemical intensity and the solar altitude is shown to be represented graphically by a straight line for altitudes above 10°, the position of the experimentally determined points lying closely on to the straight line.

A similar relation has already† been shown to exist (by a far less complete series of experiments than the present) for Kew, Heidelberg, and Parà; so that although the chemical intensity for the same altitude at different places and at different times of the year varies according to the varying transparency of the atmosphere, yet the relation at the same place between altitude and intensity is always represented by a straight line. This variation in the direction of the straight line is due to the opalescence of the atmosphere; and the authors show that, for equal altitudes, the higher intensity is always found where the mean temperature of the air is greater, as in summer, when observations at the same place at different seasons are compared, or as the equator is approached when the actions at different places are examined. The differences in the observed actions for equal altitudes, which may amount to more than 100 per cent. at different places, and to nearly as much at the same place at different times of the year, serve as exact measurements of the transparency of the atmosphere.

The authors conclude by calling attention to the close agreement between the curve of daily intensity obtained by the above-mentioned method at Lisbon, and that calculated for Naples by a totally different method.

"On the acids contained in crab oil." By William J. Wonfor, Student in the Laboratory of the Government School of Science, Dublin. Communicated by Dr. Maxwell Simpson.

* Phil. Trans. 1867, p. 558.
† Phil. Trans. 1867, p. 555.

Crab-oil is obtained from the nuts of a tree named by botanists *Hylocarpus carapa* and also *Carapa Guianensis*. The tree grows abundantly in the forests of British Guiana; the oil is prepared by the Indians, who bring it to George Town for sale. The oil is obtained from the kernels by boiling them for some time, and then placing them in heaps and leaving them for some days; they are then skinned, and afterwards triturated in wooden mortars until reduced to a paste, which is spread on inclined boards and exposed to the sun; the oil is thus melted out, and trickles into receiving vessels.

As no investigation, so far as I have been able to ascertain, has ever been made of the acids contained in this oil, Professor Galloway, to whom I am indebted for the samples of the oil, recommended me to examine them, and the examination was conducted under his direction. The acid, when pure, presents the appearance of a white glistening radiated crystalline mass. The percentage composition obtained was as follows :—

Carbon	74·856
Hydrogen	12·570
Oxygen	12·574
	100·000

These analyses agree very closely with the formula for palmitic acid, $C_{16}H_{32}O_4$.

Royal Geographical Society, March 28.—The president, Sir R. Murchison, in the chair. A paper was read by Sir Charles Nicholson, Bart., on Forrest's Journey in Western Australia; Goyder's survey of the neighbourhood of Port Darwin, and on the recent progress of discovery in Western Australia, and remarks on Papua or New Guinea. Intense interest had been felt in the fate of Leichhardt and his party, who were last heard of in 1849 S.W. of the Gulf Carpentaria; a report was brought to the government of Swan River, of the existence of the remains of two white men and horses in the unexplored region N.E. of the colony. An expedition was fitted out, under Mr. Forrest, with whom Mr. Monger and Mr. M. Hamersley were associated, and the native Jimmy Mungaro acted as guide. The place indicated was Koolanobbing, lat. 30° 53′ S., and long. 109° 14′ E. The expedition was exceedingly well managed, and the country was thoroughly examined. They left Newcastle April 19, 1869; passed through a sandy country without grass; water was scarce; salt lakes nearly dried up were met with; from the limit of Gregory's exploration, 118 long., they travelled north; found granite hills, with spearwood and acacias; in May 5 they reached Lake Moore, and learned that the remains were those of horses which had been poisoned, having strayed from an out station; some unfriendly natives, who threatened to kill and eat the white men, were met with; several large dry salt lakes were discovered, one of which, named Lake Barlee, was conjectured to be 80 miles in length, the farthest point, 28° lat. 41′ S., and 122° 50′ E. long., was reached July 2nd. The country throughout of the same barren worthless character, granite hills, no grass, and scanty supplies of water. The return journey was made to north of Lake Barlee, westward to Bunnaroo, and southward to Mount Singleton on July 23rd; the result was that no traces of Leichhardt were found, and the country explored was pronounced unfit for either pasture or agriculture. In the sea board districts and about Mount Singleton there was excellent land, all Western Australia wanted was population. Sir Charles Nicholson then proceeded to notice the recent survey of Port Darwin, in North Australia, which region, between 128° and 138° E. long., and north of 26° S. lat., had been most unreasonably annexed to South Australia. The South Australian attempt to open communication through the interior, and found a colony at Port Essington, had failed, and the colony had been abandoned. Port Darwin lies to west of Adelaide River, on northern coast, opposite Melville Island; it possesses a good harbour, a million acres of good land have been surveyed, fit for horses and cattle, not for sheep, climate from May to September is good, then moist and hot; intercourse by sea between the Malays of Macassar and this port exists. Port Darwin has been recommended as a port for shipping horses for the Indian market, the central region is impracticable, but the route followed by M'Kinlay from Northern Queensland is, in the opinion of Mr. Goyder, Colonial surveyor, the best; this, Sir Charles Nicholson thought showed that North Australia ought to form part of Queensland. Sir Charles gave a rapid *résumé* of the progress of discovery in Australia from Captain Cook's voyage, and the foundation of Port Jackson in 1788; the labours and journeys of Dr. Bass, Sturt, Mitchell, Eyre, &c., were glanced at. Dr. Leichhardt was absent two years on his first expedition to Port Essington, and was given up for lost, a monument, with an epitaph composed by a friend, having been erected to him. In conclusion a hope was expressed that geographical discovery would be still prosecuted, especially with reference to the magnificent but almost unknown Papua or New Guinea, the position, fauna, and flora of which constitute it a natural appendage to Australia, a line of small islands connecting it with our settlement at Cape York. Captain Blackwood in H.M.S. *Fly*, in 1845, examined 140 miles of coast, lat. S. 8° 45', long. E. 143° 35', to 7° 40' lat. 144° 30' long., containing the delta of a large river. In the south-eastern peninsula, mountains 11,000 ft. to 13,000 ft. high, were observed by Captain Stanley, these were in sight for several days coasting, with richly wooded slopes. The Government survey vessel at Cape York might be used for exploration of this country. The natives were hostile, and had the reputation of being fierce and warlike. The president said that he had urged on the Government the impolicy of uniting North and South Australia, and the necessity of forming a port of refuge, and a naval station at Port Darwin. He alluded to Mr. Crawford's estimate of the Papuan climate as most unhealthy. General Lefroy reminded the meeting of the omitted name of his brother, a successful explorer of Western Australia. The question of the suitability of Port Darwin as a depôt for the horses to be sent to India was discussed. The project had been favourably reported on to Lord Mayo by Sir James Ferguson, the North-eastern or Flinders river route being preferred. With regard to the climate, Mr. Findlay mentioned the excellence of the Timor ponies. Mr. Saunders pointed out that the navigation would be much safer if a port were selected in the Gulf of Carpentaria.

Chemical Society, March 30.—Anniversary meeting, Prof. Williamson, F.R.S., President, in the chair. The following officers have been elected for the ensuing year:—President, Dr. A. W. Williamson; Vice-presidents who have filled the office of president, Sir B. C. Brodie, Warren De la Rue, A. W. Hofmann, Dr. W. A. Miller, Dr. Lyon Playfair, Col. P. Yorke; Vice-presidents, Dr. J. H. Gilbert, Dr. E. Frankland, Dr. A. Matthiessen, Dr. H. M. Noad, Prof. W. Odling, Dr. T. Redwood; Secretaries, A. Vernon Harcourt, W. H. Perkin; Foreign Secretary, Dr. H. Müller; Treasurer, F. A. Abel; ordinary members of the Council, Dr. E. Atkinson, H. Bassett, E. T. Chapman, F. Field, David Forbes, Dr. M. Holzmann, Dr. E. J. Mills, Dr. W. J. Russell, Dr. Maxwell Simpson, Dr. R. Angus Smith, Dr. John Tyndall, Dr. A. Voelcker. After communication of the above list the president delivered the following address:—"Gentlemen,—On behalf of the council I feel very great pleasure in congratulating you on the rapidly increasing usefulness and prosperity of our Society. The most interesting incident in the history of the past year has been the delivery by M. Dumas of the inaugural Faraday lecture. It was indeed an impressive tribute to the memory of our great countryman which was paid by that noble veteran of science, and one of which the record ought to occupy a place of honour in our journal. We still hope to receive from M. Dumas a manuscript of his classical discourse. The council have had the pleasure of accepting the offer of a munificent donation of Palladium from Messrs. Johnstone and Matthey to be used for the preparation of the ten first Faraday medals. Your council have felt it to be of considerable importance to give greater publicity to the proceedings of the society, and they have accordingly made provisional arrangements for the preparation of abstracts of the papers, and in some cases of the discussions, for transmission to such papers as desire to publish them. These abstracts already appear in several papers and are read with interest. Another matter of considerable importance has been brought under the notice of your council, and has been by them referred to the careful consideration of a sub-committee who will report to the new council. The great activity of chemists in France and Germany leads to the publication of vast quantities of important matter in languages not easily intelligible to many of our members, and a feeling has been entertained for some time past that the progress of our science and of its applications would be greatly promoted by the regular publication in the English language of accurate reports of all chemical papers. For many years past annual reports of this kind have been published in Germany, first under the auspices of the great Berzelius, and latterly under those of Liebig and Kopp. The French Chemical Society has also added very greatly to the value of their journal by publishing in it reports of a great number of important papers from various sources, and I am happy to say that the eminent chemists who are at the head of that society concur with us in desiring to publish reports combining the completeness of the "Jahresberichte" with a much greater celerity of appearance, so that our respective members may have presented to them every month an outline of all that has been done in the science since the last report. It appears that considerable facilities would be afforded for the preparation of such reports by a joint action of the two societies, and our friends in Paris have expressed the utmost readiness to co-operate with us in this important matter. I hope at our next anniversary meeting to be able to congratulate the society on the commencement of a system of international working."

The president proceeded by giving the present number of fellows, of the foreign members, the list of the deceased, and concluded with a commemorative speech on Thomas Graham. The greater part of this speech is to be found in the biographical sketch in the first number of NATURE. The following additional remarks, however, are worthy to be quoted here. "In 1837 Graham was appointed to the chair of chemistry in the newly-founded London University, now called University College, London. It was here that the young philosopher found adequate scope for his abilities. Young men, thirsting for knowledge, crowded to his lectures, and in those lectures he explained the principles of chemical science with an exactness and clearness never before attained. The success of these lectures was not due to eloquence, nor to any smoothness of diction, for all such matters Graham usually neglected to a degree which in an ordinary person would hardly have been excused. He had a truly philosophical method which carried away the listener with irresistible force. The same exactness of thought, the same logical arrangement of matter, in a word, the same purely scientific mind pervades his work, the 'Elements of Chemistry,' a work which is too well-known to chemists all over the world, for it to be necessary to speak here of its great merits." After having sketched the outlines of the most important of Graham's investigations, the president alluded in the following manner to Graham's activity as Master of the Mint:—"He remained at University College till the year 1855, when he was appointed Master of the Mint, an office which Sir John Herschel had recently resigned. His illustrious friend Hofmann, from whom I have already freely quoted, shall tell how he discharged these responsible duties. 'It would be difficult to picture the extensive activity which Graham exercised in the high office entrusted to him. The new master of the mint showed a circumspection, a mastery of details, an amount of industry and energy, and, when occasion required, an impartial severity, which astonished every one, more especially some of the officials of the mint. Such requirements had not hitherto been made, nor such control exercised. A strong resistance was made to the plans of innovation and alteration of the new master.' The author of these lines, Hofmann, at that time held an office in connection with the Mint, and was therefore witness of Graham's struggles in his new position. It was years before he gained a complete victory, and before he was able to return to his favourite study. But at last this longed-for period came, and a series of happy years followed. Not an instant was lost. A convenient laboratory was fitted up in the official residence of the Master of the Mint, whose handsome rooms the simple and independent man never occupied, and there his old labours were resumed with greater zeal than ever. Some of Graham's most beautiful researches date from this period. They sprang from the pure love of science. Graham needed to earn no name or position. Both had long been his undisputed property. But the same earnest desire to study nature, which in early youth had induced him to bear without murmurs the greatest privations and the bitterest sorrows, still animated him and armed him against the new dangers which threatened his scientific labours from the splendour of his official position and the distractions which it entailed on him." The proceedings of the meeting terminated with a vote of thanks to the president for the able and effective manner in which he had discharged his official duties during the past year.

Geological Society, March 23.—Warington W. Smyth, F.R.S., Vice-President, in the chair. Mr. F. A. Potter, B.Sc., Assoc. Royal School of Mines, Cromford, Derbyshire, was elected a Fellow of the Society. The following communications were read:—Professor Huxley communicated a letter received by him from Dr. Emanuel Bunzel, of Vienna, giving a short account, illustrated with figures, of the posterior portion of a skull obtained by Professor Suess from a coalmine of Upper Cretaceous (Gosau) age. Dr. Bunzel stated that at the first glance this skull appeared to possess Reptilian characters, but that the convexity of the occiput, and its gentle passage into the roof of the skull, the presence of a transverse ridge in the occipital region, the absence of sutures, the globular form of the condyle, and some other peculiarities, prevent the animal to which this skull belonged from being referred to any known order of reptiles. The author compared this fragment of a skull with that of a bird, and suggested the establishment of a new order of fossil Reptiles (*Ornithocephala*), closely related to Prof. Huxley's *Ornithoscelida*. He proposed to refer his fossil to a new genus, which he named *Struthiosaurus*.

"On the discovery of organic remains in the Caribean Series of Trinidad." By Mr. R. J. Lechmere Guppy, F.L.S., F.G.S. The author described the rocks of the "Caribean group" as consisting of gneiss, gneissose, talcose, and micaceous slates and crystalline and compact limestones, and remarked upon the probable distribution of rocks of the same series on the continent of South America. In Trinidad the uppermost member of the series is a compact dark blue limestone, which contains obscure, but very abundant fossils; in the subjacent clay-slates and quartz rocks calcareous strings and bands containing more distinct traces of organisms occur. The author believed that he had detected an *Eozoon* (which he called *E. caribeum*), a *Favosites* (named *F. fenestralis*), a coral, and fragments of echinoderms. He considered it probable that the Caribean series was pre-silurian. Dr. Carpenter, from the slight examination he had been able to make of the fossils, was unwilling to speak decidedly about them. There was, however, no doubt of numerous organic remains occurring in the rocks, and among them serpuline shells and echinoderms. As to the supposed *Eozoon*, he had not been able to recognise any of the characteristics of that fossil; and by treating the Trinidad specimens with acid, he found no traces of structure left, and yet there had not been sufficient metamorphism to destroy other organisms. In some dredgings from the Ægean Sea he had found fragments of echinoderms and other organisms, in which a siliceous deposit had replaced the original sarcode in the same manner as had occurred in the Canadian *Eozoon*, thus proving the possibility of this form of substitution, which had been warmly contested. Mr. Tate offered some suggestions as to the age of these beds, which were certainly older than Neocomian. The Californian gold-bearing beds appear to be Jurassic. Similar beds occurred in New Mexico, Guatemala, and were observed by him in Nicaragua and Costa Rica. These present lithological and mineralogical affinities to the Venezuelan and Trinitation metamorphic series, and were conjectured to be of the same age.

"On the Palæontology of the Junction-beds of the Lower and Middle Lias in Gloucestershire." By Mr. R. Tate, A.L.S., F.G.S. The object of this paper was to show that the attachment of the zone of *Ammonites raricostatus* to the lower lias and that of *A. Jamesoni* to the middle lias harmonises with the distribution of the organic remains: 50 species were catalogued from the united zones of *A. oxynotus* and *A. raricostatus*, 8 of which pass up into the middle lias, whilst 13 occur in the lower horizons; 115 species were enumerated as occurring in the zone of *Ammonites Jamesoni*, 60 of which pass to higher zones, whilst 11 made their first appearance in the lower lias; the number of species common to the contiguous zones being 14. The author inferred that, as the conditions of depth and deposit of the upper part of the lower lias are repeated in the lower part of the middle lias, accompanied by a total change in the fauna, a break in the stratigraphical succession existed between the lower and middle lias. This view is supported by the fact of the numerical decrease of species in passing up through the several stages of the lower lias, and that of the introduction of many new generic types with the zone of *Ammonites Jamesoni*. Many new species were described. Prof. Boyd Dawkins had attempted to test these liassic zones as a means of classification of the rocks in Somersetshire, and the result had been that he had been unable to accept them as fixing hard and fast lines of demarcation; for he had found three of the distinctive Ammonites together in one bed. On our present shores the change of one form of molluscan life for another seemed to take place in limited areas, and to be dependent on some slight variation of physical conditions rather than on any great change. He had not been able to trace any stratigraphical unconformity between the middle and lower lias in many parts of England, whatever might be the case in Gloucestershire. Mr. Tate, in reply, gave an account of the manner in which he had arrived at his conclusions, and expressed his assent to the view that ammonite-zones were only of value over limited areas, but considered that a triple division in the lower and a dual division in the middle lias were well established on palæontological and lithological features. The break which he had pointed out was palæontological rather than stratigraphical, though the one might be inferred from the other.

"Geological Observations on the Waipara River, New Zealand." By Mr. T. H. Cockburn Hood, F.R.S. In this paper the author described the general features of the locality from which he has obtained bones of *Plesiosaurus*, *Ichthyosaurus*, and *Teleosaurus*. The bones were not obtained *in situ*, but from large boulders and blocks scattered in the ravines of the Waipara and its tributaries. Professor Boyd Dawkins remarked on the presence of Crocodilia in New Zealand being proved by the procelian vertebra.

Mr. R. H. Scott, F.G.S., communicated an extract from a letter addressed to him by M. Coumbary, Director of the Imperial Observatory of Constantinople, containing an account received from M. L. Carabello of the reported fall of a large meteorite near Mourzouk, in the district of Fezzan, in lat. 26° N., and long. 12° E. of Paris. It fell on the evening of the 25th December last, in the form of a great globe of fire, measuring nearly a metre in diameter; on touching the earth it threw off strong sparks with a noise like the report of a pistol, and exhaled a peculiar odour. It fell near a group of Arabs, who were so much frightened by it that they "immediately discharged their guns at this incomprehensible monster."

PARIS

Academy of Sciences, April 4.—The following mathematical papers were read:—Description, with plans, of an instrument, by which spherical triangles may be solved without the aid of tables of logarithms, by M. Blanqui; On the fundamental points of two surfaces, of which the points correspond one by one, by M. H. G. Zeuthen; on the theory of equations with partial derivatives, by M. G. Darboux (second memoir); and On a mode of approximation of the functions of several variables, by M. Didon.—M. de Saint-Venant presented a memoir on a second approximation in the rational calculation of the pressure exerted against a wall of which the posterior surface has a certain inclination, by incoherent soil rising in a talus from the top of this surface of the wall; and M. Boussinesq an integration of the differential equation which may furnish a second approximation in the calculation of the same pressure.—M. Jamin communicated a note on the latent heat of ice, and presented a note by MM. Wecker and Robin on an objective with prisms, to be used in an ophthalmoscope which will enable two persons to observe the eye at the same time.—M. Phillips presented a memoir by M. Martin de Brettes on an apparatus for the demonstration of the phenenomena of the trajectory of oblong projectiles driven by rifled guns.—M. Delaunay communicated an extract from a letter from M. G. Oltramare on the existence of a law of repartition, analogous to Bode's law, for each of the systems of satellites of Jupiter, Saturn, and Uranus; and a note by M. R. Wolf on the frequency of the sun's spots, and its relation to the variation of magnetic declination. The author gave a table of his observations of solar spots during the years 1864–1869, showing a minimum in 1867, in conformity with his period of $11\frac{1}{9}$ years. He also applied his formula for the calculation of the magnetic variation in relation to the solar spots, to the results of observation at the Observatory of Christiania, and cited the data of several years to show at all events a close approximation.—A paper was read by M. Chapelas on the centres of mean position of shooting stars, which is the name he gives to the points from which the groups of meteors seem to issue.—M. C. Viollette presented a paper on the existence of selenium in commercial copper. The author stated that by oxydising copper in a muffle-furnace and then heating the oxide to redness for several hours in a current of dry pure air, crystals of selenious acid are obtained. The copper operated upon by lime was probably from Chili; he proposes to examine other coppers, and requests manufacturers to forward to him, at the Faculty of Sciences of Lille, specimens of copper of known origin. M. Viollette also presented a note on the cause of the acidity of the water of organic analyses, which he ascribes to the presence of selenious acid in the oxide of copper employed in the combustion tubes.—M. E. Royer read a paper on the reduction of carbonic acid into formic acid. The author, having found that formic acid is produced by the reduction tof oxalic acid in the porous vessel of a Bunsen's battery in presence of hydrogen, has subjected carbonic acid to the same treatment, and found that this also furnishes formic acid.—M. Maumené forwarded a further note on his general theory of chemical action; and M. Dubrunfaut a paper on the law of dilatation of gases.—M. Guyon communicated some remarks on a paper by M. Ramon de la Sagra, describing an anomalously branched structure in the stem of a palm-tree (*Oredaxa regia*). M. Guyon stated that a similar anomaly is very common in the date palm.—In a note presented by M. de Quatrefages, on the inversion of the viscera and its artificial production, by M. C. Dareste, the author stated that he had produced this condition in young chicks, by maintaining a temperature at the heating point of 105·8°—107·6° F., whilst the surrounding temperature was allowed to oscillate from 21° to 28°.—M. Bouley communicated an important report on the results of the inquiry instituted by the Ministry of Agriculture into the occurrence of hydrophobia in France during the years 1863-1868. From his statements, which unfortunately rest on rather imperfect documents, it appears that a large number of persons bitten by dogs supposed to be rabid, escape all serious consequences of the bites; that the summer is not more dangerous than any other season; and that immediate cauterisation of the bite appears to be the only sure remedy.—M. H. Sainte-Claire Deville presented a note by M. Piarron de Montdésir on ventilation by means of compressed air, accompanied by a purification and cooling of the new air, and a disinfection of the vitiated air. The author proposed to employ strong jets of compressed air, which would carry with them a considerable body of uncompressed air; the cooling and purification of this air from dust is to be effected by means of a small jet of water in the midst of each air-jet; and the purification of the vitiated air by substituting a disinfecting liquid for the water in the jets of compressed air in action at the bottom of the ventilating flues. With regard to M. Wœstyn's recent proposal to purify the vitiated air of hospitals, &c., by burning it, which is rejected on the score of expense by the author, M. Montanier remarked that in 1864 he had suggested a similar plan.—MM. Mille and Durand Claye presented a memoir giving the results of the experiments made for the utilisation of the sewage waters flowing into the Seine, which they propose to divert entirely from their direct influx into the river, and to apply as manure to the neighbouring country.

VIENNA

Imperial Academy of Sciences, February 17.—The president noticed the decease of Dr. Franz Unger, the well-known botanist and vegetable palæontologist, on the 13th Feb.—The following papers were read:—1. On the observation of oscillations by Prof. E. Mach of Prague. He stated that a very simple and effective form of vibroscope is obtained by placing a row of König's burners along one side of an organ pipe, and described some of the effects observable by means of this instrument.—2. On the intestinal movements, by Dr. S. Mayer, containing the results of a series of experiments, relating especially to the innervation of the intestines, which had been made by him in conjunction with Dr. S. von Basch.—3. Dr. Boué completed his address on the petrographic and geognostic results of his travels in European Turkey.—The reports of observations at the Central Institution for meteorology and terrestrial magnetism during the month of January, were communicated.

March 10.—The president announced the death of Professor Joseph Redtenbacher on the 5th March. The following papers were read:—1. On the renal pelvis of the mammalia and of man, by Professor Hyrtl, in which the author described in detail the structure of the urine-secreting organs in a great number of mammals.—2. Phanological studies, by M. Karl Fritsch, containing the results of observations made in Austria and Hungary on the blooming and maturity of plants, and on the first and last appearances of periodically occurring animals.—3. On the after-pictures of excitant changes, by M. V. Dvorák, showing that the after-pictures of movements observed by Plateau and Oppel are not isolated phenomena, but that similar effects are produced by changes of brightness.—4. On the rational triangle by M. H. Rath.—5. On the simple construction of obliquely turned hyperboloids and paraboloids by Professor R. Niemtschik.—6. On a cosmical attraction exerted by the sun through its rays, by M. C. Puschl, in which the author sought to prove that by means of the æther-waves issuing from it the sun exerts an attraction upon opaque bodies, equivalent to the repulsion which it must have produced, according to the hypothesis of emanation, by the material particles emitted by it.—7. On the atomic heat of oxygen in its solid compounds, by M. J. Tollinger.—8. On the action of *Digitalis* and *Tinct. Veratri viridis* upon the temperature in crupose pneumonia, by Dr. L. von Schrötten.—9. Prof. V. von Lang delivered an address upon a new method of investigating the diffusion of gases through porous septa. His apparatus consists of a porous cell united by a thin caoutchouc tube with the air-tube of a Mariotte's bottle, so arranged that the gas in the cell is always under the atmospheric pressure, and as soon as an increase of volume takes place in it the excess flows over into the bottle, displacing an equivalent amount of water, which is determined by weighing.—10. The second part of investigations on ammonites by Prof. Suess, in which the author treated chiefly of the structure of the shell in the Cephalopodous mollusca. He showed that the shell which exists in the females of the existing genus *Argonauta*, is to be regarded as a rudimentary ammonite shell, consisting of an ostracum or outer layer without a nacreous layer, and that *Argonauta* belongs to a great group, commencing with *Trachiceras* and including *Cosmoceras*, *Toxoceras*, *Crioceras*, many *Scaphites*, and the *Flexuosi*.

DIARY

THURSDAY, April 14.

Mathematical Society, at 8.—On the Mechanical Description of a Nodal Bicircular Quartic: Prof. Cayley.

MONDAY, April 18.

Royal Asiatic Society, at 3.

TUESDAY, April 19.

Anthropological Society, at 8.—On the Hypothesis of Pangenesis applied to the Faculty of Memory: Mr. Alfred Saunders.—Note on Consanguineous marriages: Mr. G. C. Thompson.

WEDNESDAY, April 20.

Meteorological Society, at 7.
Society of Arts, at 8.

THURSDAY, April 21.

Linnean Society, at 8.—On the Vertebrate Skeleton: Mr. St. George J. Mivart.
Chemical Society, at 8.

BOOKS RECEIVED

English.—Forms of Animal Life: Prof. Rolleston (Clarendon Press).—Manual of Zoology: Dr. Nicholson (Hardwicke).—Alpine Flowers for English Gardens: W. Robinson (Murray).

Foreign.—Ueber Gährung und die Quelle der Muskelkraft, und Ernährung: Liebig.—Through Williams and Norgate.

CONTENTS

Errata.—In No. 23, page 580, second column, line 1: for "Langel," read "Laugel;" for "Lartel," read "Lactet."—Line 3: for "carnulorum," read "carnutorum."—Line 4: for "Trojonotherium," read "Trogontherium."